Middle Missouri River Creel Survey 2019

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Montana Fish, Wildlife and Parks

September 13, 2022

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Funded by Northwestern Energy Company (FERC 2188)
Proposal 2019-10

Summary

An angler creel survey was conducted by boat along 201.2 miles of the Middle Missouri River (MMR) from April 18 to September 27, 2019. Anglers were interviewed at access points and along the river corridor when encountered within daily survey sections. The MMR was divided into four sections: Upper, Middle, Lower, and Robinson based on similar surveys conducted in 2003, 2007, 2011, and 2015. Additionally, a fifth section was surveyed in the Marias River from the Missouri River confluence to Loma, MT. In 2019, a record high of 741 anglers were interviewed resulting in a total of 5,435.7 hours of angling time. We observed 215 motorized and 311 nonmotorized watercraft were observed, the highest number of observations among past creel surveys. The majority of anglers surveyed (94.3%) were Montana residents, with 52.3% of respondents being from counties adjacent to the MMR study area. Hook and line fishing was the most common angling method followed by snagging for Paddlefish *(Polyodon spathula)*. Worms were the most common single bait used (30% of all bait used by anglers). Approximately 50% of anglers interviewed had no target species or were targeting multiple species. Channel Catfish (*Ictalurus punctatus)* were the most singularly targeted species (20.8% of all anglers). However, Goldeye *(Hiodon alosoides)* were the most commonly caught fish species with a catch rate of 0.20 fish/hr. Channel Catfish and Walleye *(Sander vitreus)* had the highest angler catch rates among all game fish at 0.14 fish/hr and 0.02 fish/hr, respectively. Freshwater Drum *(Aplodinotus grunniens)* were also caught in high numbers, with 412 caught in 2019. Sauger *(Sander canadensis)* catch rates were the lowest recorded during all survey years at <0.01 fish/hr with only 39 fish reported. The decreasing trend in Sauger catch rates will be monitored closely in coming years.

Despite widespread flooding and delayed river access in 2019, the MMR continues to offer a diverse and quality fishing experience. A record high number of interviews were completed in 2019. A total of 2,177 fish were caught by interviewed anglers, the second highest of any creel year. Channel Catfish were the most targeted species (72.2% of anglers) with the catch rate the second highest observed in the five survey years. However, in stark contrast with 2015, catch rates for other game species were the lowest observed during all survey years. Sauger catch rates have been steadily declining in the Upper Section since the late 1970's and were <0.01 fish/hr in 2019, the lowest observed. The Lower Section has historically provided good fishing opportunities in the spring for several species including Walleye and Sauger. Reduced catch rates during the 2019 survey may be due to the large ice jams that caused flooding in the Lower and Robinson survey sections and prevented anglers from launching boats and fishing until late April.

This survey provided excellent angler outreach for the endangered Pallid Sturgeon *(Scaphirhynchus albus)*. The survey also allowed anglers an opportunity to comment on both their fishing experience and how the fishery is managed. In 2019, 134 public comments were received with 38% of anglers saying they support current regulations and are satisfied with how Montana Fish, Wildlife & Parks (FWP) is managing the fishery. Another 27% of comments referred to regulation changes with the most common suggestion being to increase the Sauger limit. The creel survey provided important information on catch rates, fishing methods, and angler residency that are vital for informing future management decisions.

Contents

Table Captions

Figure Captions

Appendix Captions

Introduction

Creel surveys are an important tool for determining angling pressure, long-term angling trends, angler outreach, and evaluating management decisions. Berg (1981) conducted the first recreational survey on the MMR during 1977-78. This is the fifth time in recent years that the MMR Creel Survey was conducted. Previous surveys were conducted in 2003 (Gardner and Leathe 2005), 2007 (Gardner and Wente 2008), 2011 (Tews and Gardner 2012), and 2015 (Tews 2016). The information generated from this survey can provide insight into the impacts of the Northwestern Energy (NWEC) Great Falls hydropower dam operations on fisheries resources as directed by the Federal Energy Regulatory Commission, re-licensing order 2188, Article 417. Also, the data from the study will be useful regarding the effects of the Recreation Plan (Article 426) and add to other recreational use studies in this reach.

The Middle Missouri River (MMR) is a 238-mile reach from Morony Dam, near Great Falls, to the confluence with the Musselshell River (Figure 1). The river meanders through remote scenic canyons and cottonwood bottoms and is a highly acclaimed wildlife and recreational area. Over 80% of the study area lies within the Upper Missouri River Breaks National Monument or the Charles M. Russell National Wildlife Refuge. In 1976, portions of the Missouri River were federally classified as Wild and Scenic. As such, there are motorboat use restrictions on most of the river from June 15 – September 15. Recreational access is limited, with only 7 public boat ramps throughout the reach located at Widow Coulee (River mile [RM]-2102.2), Carter Ferry (RM-2089.2), Fort Benton (RM-2073.2), Wood Bottom (RM-2053.6), Judith Landing (RM-1983.3), Fred Robinson Bridge (RM-1920.7) and Rock Creek (RM-1907). There are also canoe launches at Coal Banks (RM-2031) and upstream from Fort Benton (RM-2074.4). Recreationists also use the nearby county road at Virgelle Ferry to launch both motorized and nonmotorized craft (Figure 1).

The FWP fisheries objective for the MMR is to emphasize native species management (MFWP 2019). It supports a diverse warmwater fishery, with all of the historic native fish species still found in the reach. There are substantial angling opportunities for native species such as Sauger *(Sander canadensis)*, Channel Catfish (*Ictalurus punctatus)*, Shovelnose Sturgeon *(Scaphirhynchus platorynchus)*, Freshwater Drum *(Aplodinotus grunniens)*, Burbot *(Lota lota)* and numerous nongame species. Introduced species including Smallmouth Bass *(Micropterus dolomieu)* and Walleye *(Sander vitreus)* are also heavily targeted by the angling public. The lower 40-mile reach of the MMR sustains a popular Paddlefish *(Polyodon spathula)* snagging fishery (Nagel 2013). A lottery system for Paddlefish harvest tags was implemented in 2016 to control overcrowding of anglers. In 2019, there were 1000 Paddlefish harvest tags issued to anglers with an estimated 305 Paddlefish harvested by anglers (Nagel 2020).

Objectives

1. Interview anglers for catch and harvest rates of game and nongame fish species.
2. Determine size and age structure of harvested game fish in the study area.
3. Monitor recreational use of the Middle Missouri River over time.
4. Provide public outreach regarding the Pallid Sturgeon Recovery Program.
5. Gather and summarize public comments on the Middle Missouri River fishery.

Methods

The 2019 MMR Creel Survey was conducted from April 18 to September 27. A roving creel design was used, similar to past years. A single creel clerk conducted surveys from a jet boat along a 201.2-mile reach of the Missouri River between Widow Coulee FAS (RM-2102.2) and Wilder Coulee (RM-1901). Interviews were also conducted on the Marias River from the Missouri River confluence to the Highway 87 Bridge near Loma, MT. Anglers were asked for information on their current and previous day fishing experience. An additional interview form was filled out for any fishing done the day before and labeled as the "B" interview (See Appendix 1 for a copy of the creel survey form). One complete survey trip of the study reach took 4 days for the upper half (Widow Coulee to Judith Landing), and 4 days for the lower half (Judith Landing to Wilder Coulee). The order that the sections and subsections were surveyed was randomly selected for each trip. Survey section locations (Table 1) were based on previous MMR creel surveys and the Montana Statewide Mail Angling Pressure Survey (FWP Pressure Survey) (MFWP 1990 – 2019). Due to slight differences in river section boundaries and analysis, all previous creel survey data were reviewed and standardized for comparison.

Angler residence, satisfaction, and comments were summarized for only the initial interview per survey trip to avoid duplication. Target species, catch rates, type of bait used, and fishing method summaries included both initial interviews and previous days interviews, reflected by differing N values reported in figures and tables throughout this report. Anglers that caught fish were asked to rate their satisfaction with both the number and size of fish caught. To obtain as many complete daily trips as possible, anglers were provided with a stamped post card for completing the day's fishing results (Appendix 2). In order to incentivize angler response, anglers who returned the information requested on the post card, were entered into a raffle for one of two $100 gift cards. Post cards that had additional catch but were missing additional time spent angling were corrected using either the average additional time fished from all anglers that returned cards, or by assuming they fished until sunset if interviewed within one hour of sunset. Cards that included additional time fished but did not include additional catch were assumed to have not caught any additional fish. All post cards missing both additional time spent angling and additional catch were excluded from analysis.

With angler permission, any fish possessed while the creel clerk was present were measured to the nearest 0.1 inch, weighed, and had an aging structure removed. The first and second anterior dorsal spines from Sauger, Walleye, and Smallmouth Bass, and a pectoral spine from Channel Catfish and Shovelnose Sturgeon were taken for aging purposes following methods by Quist and Isermann (2017). Due to variability and concerns with previous aging data and methods this survey implemented new standardized protocols. In previous years, a single reader estimated the age of a fish. Conversely, in 2019, three separate readers estimated age using cross-sections of dorsal or pectoral spines. When ages differed between readers, the age would be estimated by reading the structure as a group and coming to a consensus. Additionally, three cross-sections were aged for each fish facilitating calculation of a coefficient of variation. Age estimates were then compared with a coefficient of variation test, and the age of the cross-section with the lowest coefficient of variability for each fish was used in analysis.

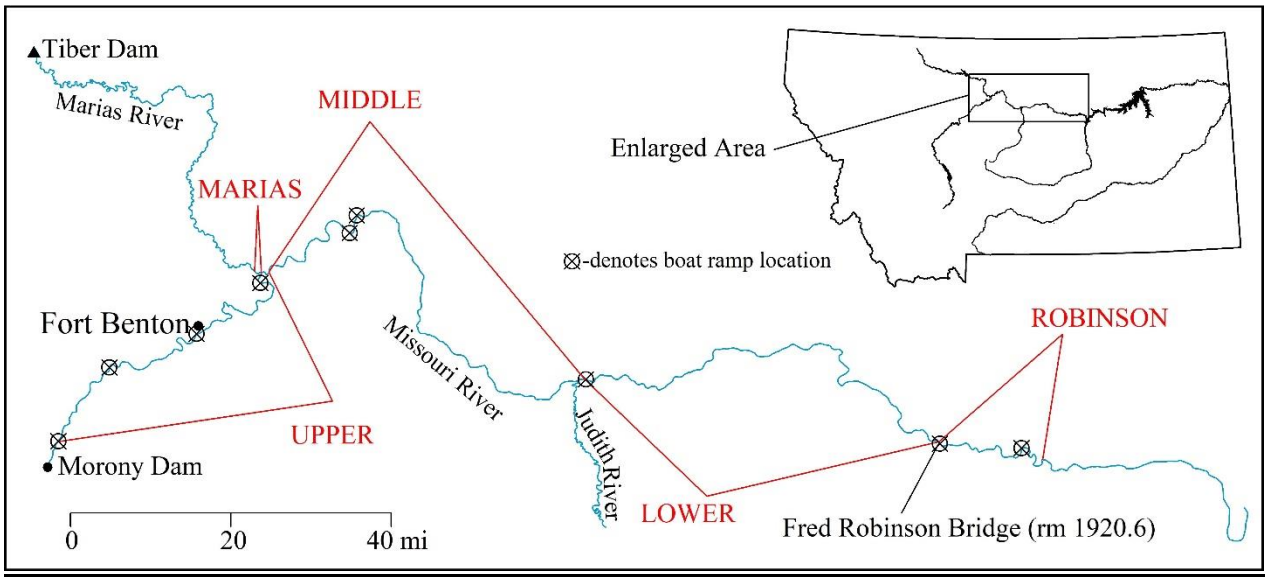

Figure 1. Publicly accessible boat launches (black circle with x) and survey sections (in red) within the Middle Missouri River Creel Survey study area.

Table 1. Location, length (miles), and number of public access points for each section in the MMR Creel Survey study area.

Section	Location	Length (mi)	# of public access points
Upper (Widow Coulee to Below Marias River)	RM 2051- 2102.2	51.2	9
Middle (Below Marias River to Judith Landing)	RM 1983.3-2051	67.7	4
Lower (Judith Landing to Fred Robinson Bridge)	RM 1921-1983.3	62.3	7
Robinson (Fred Robinson Bridge to Wilder Coulee)	RM 1901-1921	20	11
Marias Confluence (Loma Bridge to confluence with Missouri)	RM 0-1	1	4

Results and Discussion

Environmental—Large ice jams during the spring of 2019 caused substantial flooding that inhibited angler access for several months in the Lower and Robinson creel survey sections. Similar flooding occurred in 2011 and influenced creel survey results (Figure 2). The United States Geologic Survey (USGS) gage at Landusky recorded a maximum height of 36.55 feet, in late March of 2019, before exceeding the recording limit for this gauge. During fisheries field investigations outside of this creel survey, four radio tagged Pallid Sturgeon were found dead on the high upper bank in the spring of 2019. It is believed that these fish were displaced and stranded during rapidly fluctuating water levels caused by ice jams in March. Several other radio tagged fish are suspected to have died in the river channel during this event. Mortalities of other species were also observed and reported by anglers, but population-level impacts are unknown at this time.

The mean daily discharge in the month of April at the Landusky USGS streamflow gage (06115200) was 15,073 cfs, the second highest observed since 2001, and the highest observed among creel survey years (Figure 2). Annual mean daily discharge at Landusky was 10,292 cfs which was the third highest since 2001, and second highest (2011) among creel survey years (Figure 2).

Survey Effort— In 2019, 24 boat trips totaling 2,943.7 miles were completed by the creel clerk with each half of the study area surveyed 12 times (Appendix 3). A total of 994 interviews were conducted during the 5.5-month survey period with 253 of the interviews being from the previous fishing day. An additional 188 mail-in post cards were returned and used in analysis. Although sampling effort was similar throughout the 201.2-mile reach, the distribution of interviews varied by both section and month (Figures 3 and 4). In 2019, the majority of interviews were conducted in May (Figure 3). June had the second most interviews of any month. April had the fewest interviews, likely due to the poor conditions for access and camping caused by ice jams and associated flooding. In 2019, the Upper (29.8%), Robinson (27.3%), and Lower sections (21.8%) had the most interviews (Figure 4). Distribution of angler interviews is likely closely tied to fishing conditions each year, but some trends are consistent. The month of May had the highest number of interviews in every year, except for 2007 (Figure 3). The Upper Section was in the top two for number of interviews conducted among creel years the last 4 surveys (Figure 4).

Survey effort in the Robinson Section during Paddlefish season (May 1- June 15) has varied in the past. In 2003, 2011, 2015, and 2019 the Paddlefish season was included in the creel survey. In 2007, creel survey interviews were not conducted in the Robinson Section during Paddlefish season because there was an ongoing independent Paddlefish specific survey that focused on Paddlefish anglers in that section (Nagel 2013). In 2011, flooding prevented access to the Lower and Robinson Sections during the scheduled survey trips during Paddlefish season. Thus, more interviews with Paddlefish anglers were conducted by the creel clerk in 2019 than in 2011 and 2007. During the 2019 Paddlefish season, 96.8% of the anglers in the Robinson Section were targeting Paddlefish.

Angler Residency—A total of 1,657 people were observed on or near the water during the 2019 MMR Creel Survey, and 56.4% of the people observed were anglers (Table 2). There were 311 nonmotorized and 215 motorized vessels observed (Appendix 3). Of all the anglers

interviewed, 94.3% were Montana residents. Cascade County residents accounted for almost 30% of all anglers interviewed, and Fergus and Chouteau residents each accounted for over 10% of all anglers interviewed. Angler residency trends were similar to past creel surveys.

Fishing Methods—Of the three fishing methods observed during the MMR 2019 creel survey, hook and line fishing (67.5% of anglers) was the most common (Table 3). Set line fishing continues to be uncommon and was the sole method used by only 0.3% of anglers. Additionally, 5.3% of anglers used a combination of setlines and hook and line fishing. Snagging for Paddlefish continues to be popular with 25.6% of anglers snagging or hook and line fishing and snagging. The majority (64.8%) of anglers interviewed were fishing only from the bank (Table 4). Fishing from a motorboat was the singular method used by 15.3% of anglers interviewed. Additionally, 15.2% of anglers fished from a combination of the bank and a motorized boat. About 49% of anglers interviewed were targeting a single species (Table 5). Channel Catfish (20.8%), Paddlefish (18.5%), and Walleye (5.4%) were the most common singularly specified targeted species. Approximately 50% of anglers interviewed specified multiple or no target species (Table 5). A breakdown of the species targeted by anglers who specified multiple species can be found in Table 6. Worms were the most common single bait used (29.9%) among all sections (Table 7). Artificial lure/bait combo was commonly used in the Upper and Middle sections with over a third of anglers using them in both sections. In 2019, treble hooks (used for snagging Paddlefish) were separated out from other artificial lures and were the only tackle used by 14% of anglers interviewed over the course of the creel survey.

Angler Effort and Catch Rates—The creel clerk interviewed 741 anglers (Table 2) that reported 4,659.3 hours using a combination of gear types, and 776.4 hours of only snagging for a total of 5,435.7 total hours of fishing in 2019. In 2019, 268 anglers reported trips that averaged 6.6 hours when excluding setlines, which are often fished overnight for several days at a time. Twenty-one different species of fish were caught during the 2019 survey with 1,965 fish released, and 746 fish harvested and reported to the creel clerk. Goldeye *(Hiodon alosoides)* was the most common species caught in 2019 at 0.20 fish/hr. Channel Catfish and Walleye were the most common game fish caught, averaging 0.14 and 0.02 fish/hr, respectively (Table 8). Overall catch rates had been increasing each year from 0.48 fish/hr in 2003 to 0.91 fish/hr in 2015 but were the second lowest recorded in 2019 at 0.50 fish/hr. Sauger and Walleye catch rates in 2019 were at record lows, likely due to high discharge, low temperatures, and poor access in April. Overall catch rate for Shovelnose Sturgeon (0.01 fish/hr), and Smallmouth Bass (0.01 fish/hr) in 2019 were both record lows among creel survey years (Table 9).

Catch rates that had been increasing since 2003 all decreased in 2019, except for Channel Catfish and Freshwater Drum (Table 9). One contributing factor to this decrease in angler catch rate is the flooding caused by ice jams that limited access on the Missouri River (Figure 2). Access was limited to the Lower and Robinson sections during spring and early summer, which are often the best times of the year to catch several species including Walleye and Sauger.

Length and Age Statistics—Length statistics of game fish measured during the 2019 creel survey are similar to fish observed during the annual electrofishing and trammel netting surveys (Tables 10 and 11). Many of the angler harvested fish had already been filleted and were not available for measurement. Age analysis was only completed for common game fish species and

consisted primarily of harvested fish. During the 2019 creel survey the average age for Sauger was 3.5 years and ranged from 2-6 years old, Walleye averaged 4.0 and ranged from 2-7 years old, Smallmouth Bass averaged 5.9 years and ranged from 4-11 years old, and Channel Catfish averaged 9.3 years and ranged from 5-15 years old (Table 10). One Shovelnose Sturgeon was aged at 28 years old. The 2019 fish age estimates differ from previous years, especially for Walleye and Sauger, likely due to updated aging methods and changes in age structure reading protocol (Table 12). Many studies have indicated that otoliths are preferable to spines for aging fish as spines may underestimate age (Maceina and Sammons 2006, Kocovsky and Carline 2000). If possible, future Creel Surveys should consider using otolith structures to age harvested fish.

Angler Satisfaction—Anglers that caught fish were generally very satisfied or somewhat satisfied with both the size and number of the fish they caught (Table 13). This creel survey provided excellent outreach to anglers and an opportunity for anglers to comment on the fishery. Angler comments are summarized in Appendix 4. The most common comment received was that FWP is doing a good job managing the fishery. Several people commented that they would like to see the Sauger limit increased.

Comparison with Pressure Survey—The MMR Creel Survey is conducted on a quadrennial basis to coincide with every-other FWP Pressure Survey to facilitate comparison between them. The FWP Pressure Survey is a mail survey done biennially to evaluate fishing pressure throughout Montana. Large river systems, such as the Missouri, are often broken down into several sections to facilitate detailed monitoring (MFWP 1990 – 2019). The four sections of the Missouri River used for the creel survey coincide with three sections as defined in the FWP pressure surveys, with the Lower and Robinson sections being combined. The FWP Pressure survey is also broken into the summer season (May 1 to September 31) and winter season (October 1 to April 30). Previous creel reports used estimates for the entire year making comparison difficult. For this report only angling pressure estimates from the summer months were used.

Angling pressure estimates from the FWP Pressure Survey do follow some of the same trends as the MMR creel surveys. Both surveys show an overall increase in angler use over time (Figures 5 and 6). A steady increase in angling pressure in the Upper Section is also suggested by both surveys (Figures 5 and 7). The total number of angler days estimated by the FWP Pressure Survey for the whole study area was steeply increasing until 1999 but has leveled off in recent years (Figure 5). This is contrary to the continual stable growth of both anglers and number of interviews seen in the MMR creel surveys (Figure 6).

The percentage of non-resident anglers often differs between the two surveys. In 2019, non-residents consisted of 5.7% of total anglers for the creel survey, compared with 13.4% for the FWP Pressure Survey (Table 2 and 14). Middle Missouri River creel surveys have consistently found non-residents composed 7.4% or less of total anglers interviewed. In contrast, the FWP pressure survey non-resident estimates ranged from 6.1-20.7% of all anglers (Table 14). The number of anglers, non-anglers, motorized boats, and non-motorized craft were all the highest observed among creel years in 2019 (Table 2 and Figure 6).

The differences between the two surveys are likely due to the variability in creel survey coverage of the Paddlefish snagging fishery, mail survey effort, and diminished mail survey returns in recent years. As stated earlier, several previous MMR creel surveys did not interview Paddlefish anglers as there was a separate Paddlefish specific creel survey being conducted by FWP in Region 6. The FWP pressure survey estimates, and angler trip estimates are for May 1 to September 30 whereas, the start and end dates for the MMR Creel survey differ depending on river conditions. The number of surveys mailed out to the public has varied from 40,300 to 97,000 since the first MMR creel survey in 2003 (MFWP 1990 – 2019). The mail return rates have steadily been decreasing since the beginning of the mail surveys and were less than 37% for residents and non-residents in 2019. These lower return rates have led to increased levels of error in the pressure estimates.

Species of Concern—Sauger are a species of special interest to this survey because they experienced widespread decrease in abundance in the MMR in the 1990's (McMahon 1999). In 2000, as a result of low Sauger numbers, the combined Sauger/Walleye daily limit of five was changed to only include one Sauger in the Upper, Middle and Marias sections and then expanded to include the entire study area two years later. In 2016, the combined Sauger/Walleye limit was increased so two of the five fish may be Sauger in response to increased abundance observed during annual trend monitoring. During the 2019 creel survey, only 39 Sauger were caught by anglers and 17 of these were released (Table 8). Of the 26 anglers that caught Sauger, 43.6% kept all they caught and 50% did not harvest any. Sauger catch rates among creel surveyed anglers had been steadily increasing from 2003 to 2015, but in 2019 fell to a record low (Table 9). Furthermore, many other species in the MMR experienced increasing relative abundance during the period following the flooding in 2011, but have subsequently declined in the past five years (Holmquist 2022). Low catch rates of other species during the 2019 MMR creel survey, and over the past five years of FWP electrofishing surveys, indicate that biotic and abiotic factors are likely more influential than angler harvest on fish densities. Interspecific competition with non-native Walleye and Smallmouth Bass may also be contributing to observed declines in Sauger catch rates in both the creel survey and electrofishing surveys (Bellgraph et al. 2008).

Reduced Sauger catch rates observed during the 2019 MMR creel survey may be exaggerated because of limited access to boat launches and camping locations during the spring Sauger spawning season (Figure 3). Sauger throughout the MMR congregate to spawn in early spring in the Lower Section of the MMR, near Fred Robinson Bridge (Gardner and Tews 2012). This Sauger spawning aggregation typically coincides with Paddlefish snagging season when angler use of this reach is high. The predictable nature and large congregations of Sauger in this area could leave them vulnerable to high harvest. In the 2019 creel survey, 43.6% of all the Sauger reported were caught in April and May within 20 miles of Fred Robinson Bridge. Radio transmitter tag-return information from a 2012 study suggest that Sauger harvest rates may be high in the MMR (Gardner and Tews 2012). In 2021, FWP began T-bar tagging (Floy Tag and Manufacturing, Seattle, WA) large numbers of Sauger and Walleye in the MMR to monitor and better understand angler exploitation (Holmquist 2022 in preparation).

Shovelnose Sturgeon are another species of special interest because they are vulnerable to over exploitation as a result of their life history requirements. Quist et al. (2002) believed there is potential for over-fishing this population even with low exploitation rates. The 2007 – 2019

surveys have indicated a moderate harvest of Shovelnose Sturgeon (Table 8). The proportion of Shovelnose Sturgeon that were caught and harvested was 30% in 2019 (Table 8), 28% in 2015 (Tews 2016), 67% in 2011 (Tews and Gardner 2012), and 62% in 2007 (Gardner and Wente 2008). Shovelnose Sturgeon population estimates completed near Fred Robinson Bridge in 2009 and 2015 indicated their numbers had changed little in that six-year period, but average size did increase, potentially indicating limited recruitment (Tews 2016). Conversely, higher numbers of young-of-the-year Shovelnose Sturgeon were observed during 2019 standardized sampling than previous years which is encouraging for the species future (Holmquist 2022). Future monitoring is needed to determine if a large year class of Shovelnose Sturgeon from 2019 spawning events will recruit to the adult population.

Listed in 1990, the Pallid Sturgeon is an endangered species. Starting in 1993, FWP worked with federal partners to develop and implement a successful Pallid Sturgeon hatchery stocking program. This program has increased their numbers from less than 100 wild fish (Gardner 1996) in the early 1990's to an estimated 4,109 Pallid Sturgeon in 2016 (95% CI, 3489 to 4731; Rotella 2017), which was much lower than the previous estimate of 7,935 (Rotella 2015). The number of Pallid Sturgeon being caught and reported during a creel year has been increasing steadily. In 2019, 78 were caught and released, followed by 36 in 2015, 21 in 2011, four in 2007, and one in 2003. Informational signs are posted at all major public access points on the river to educate anglers and aid anglers in identification of endangered Pallid Sturgeon and prevent incidental harvest (Figure 8). The creel clerk indicated that anglers often asked about Pallid Sturgeon identification and found the signs helpful for differentiating Pallid Sturgeon from Shovelnose Sturgeon. The MMR creel survey also provided a great opportunity to educate the public about the current radio and PIT telemetry project being conducted on the Missouri, Marias, and Teton rivers by FWP and partners.

The Middle Missouri River remains an excellent place to catch a diverse array of Montana's native species. In recent years, non-native game species have become an important aspect of the recreation in this reach. Smallmouth Bass and Walleye were rarely encountered during 1977-78 angler surveys, but in recent creel years those two species have become among the most frequently caught species in certain sections (Table 9). In 2019, Smallmouth Bass had the second highest catch rate of any game fish in the Upper Section and Walleye the third highest. However, with the addition of non-native predatory game fish species future monitoring and management of the system is important to ensure native species populations are maintained within historical abundances.

Recommendations

1. Continue the Middle Missouri Creel Survey in a similar form every four years.
2. Work with Region 6 call survey to ask questions about Sauger and Pallid Sturgeon to obtain more details on harvest and catch rates for these species.
3. Consider taking otoliths from harvested fish or consider discontinuing the collection of aging structures in future surveys.
4. Maintain Pallid Sturgeon identification signs.
5. Monitor Sauger to better understand angler exploitation and the potential for exploitation to have population level impacts on Sauger.

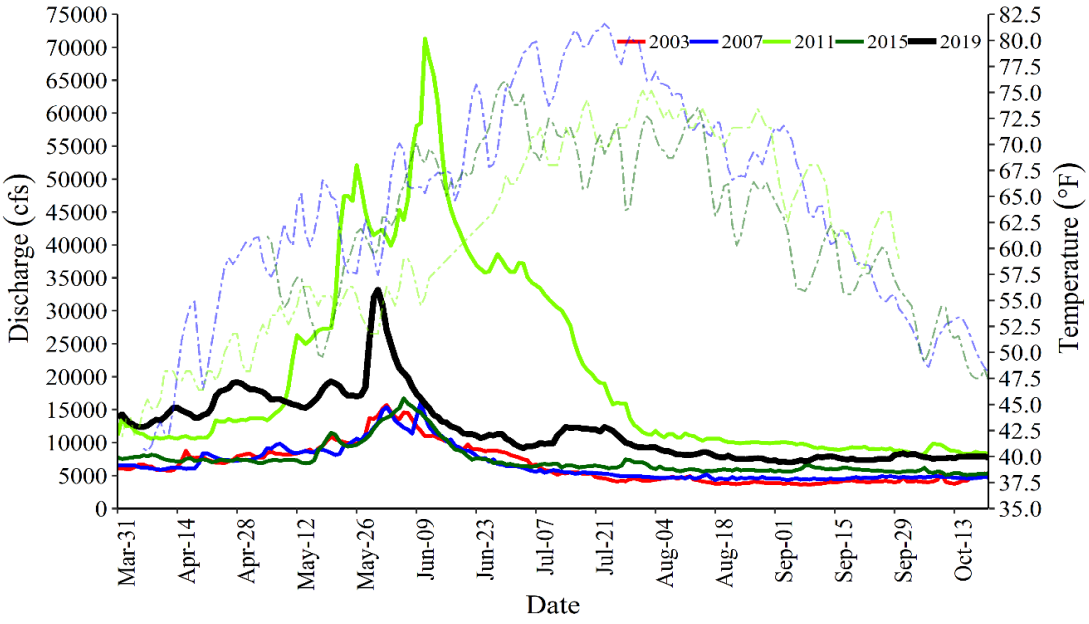

Figure 2. Mean daily discharge (cfs) and water temperature (°F) of the Missouri River at Fred Robinson Bridge (USGS Landusky station) during all Middle Missouri River Creel Survey years.

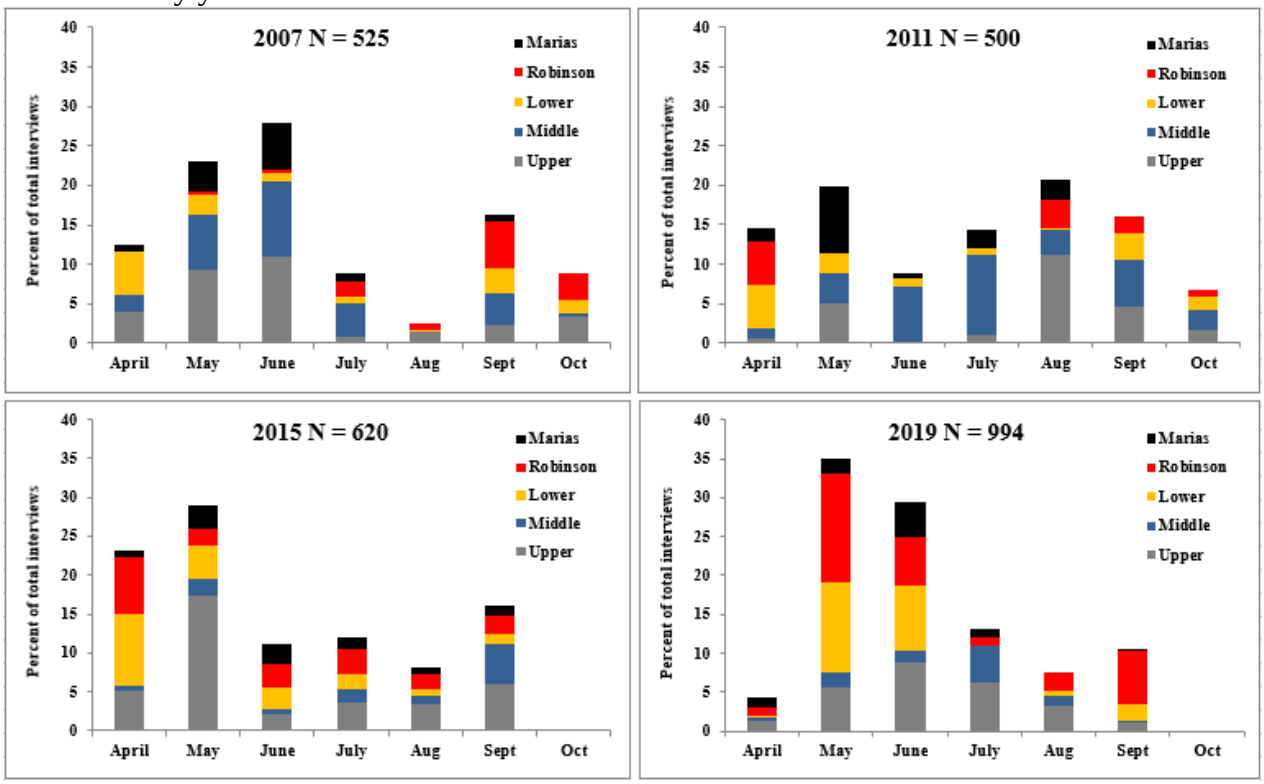

Figure 3. Temporal distributions (monthly) of interviews conducted during the 2007 - 2019 Middle Missouri River Creel Surveys. Includes breakdown of where interviews occurred within each month. In 2007, the creel survey did not occur in June on the Robinson section.

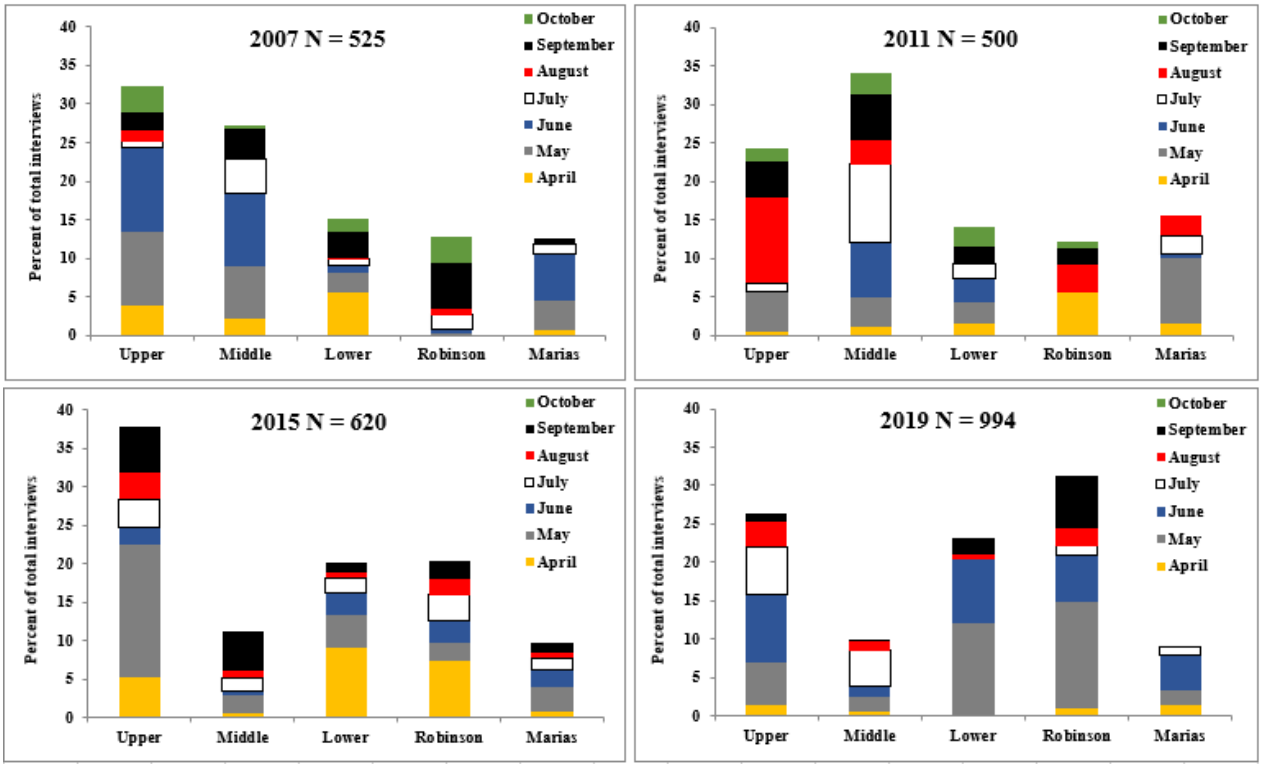

Figure 4. Spatial distribution of interviews conducted during the 2007 – 2019 Middle Missouri River Creel Surveys. Includes a breakdown of when the interviews occurred within each section. In 2007, the creel survey did not occur in June on the Robinson section.

Table 2. Angler residency trends by county for all creel survey years in the Middle Missouri River based on initial interview per creel trip.

	Percent Residents per Year				
Residence	2003	2007	2011	2015	2019
Cascade County	23.8	36.4	30.4	32.7	29.8
Fergus County	17.5	15.0	15.7	11.0	11.6
Chouteau County	7.8	17.6	13.8	4.0	10.9
Yellowstone County	9.1	4.9	9.4	11.5	8.0
Other Montana Counties	36.3	21.0	23.3	34.2	34.0
Non-Resident	5.5	2.2	7.4	6.5	5.7
# of Anglers Interviewed	361	448	434	599	741

Table 3. Gear type used by anglers in each section of the Middle Missouri River during the 2019 creel survey.

	Percent of Anglers					
Gear Type	Overall	Upper	Middle	Lower	Robinson	Marias
Rod	67.5	96.6	84.2	29.1	56.9	97.8
Rod/Setline	5.3	3.4	15.8	0.9	7.0	2.2
Rod/Snagging	11.1	0.0	0.0	27.0	15.3	0.0
Rod/Snagging/Setline	1.0	0.0	0.0	0.4	2.9	0.0
Setline	0.3	0.0	0.0	0.4	1.3	0.0
Snagging	14.5	0.0	0.0	41.3	15.7	0.0
Snagging/Set	0.5	0.0	0.0	0.9	1.0	0.0
# of Interviews	998	263	101	230	313	91

Table 4. Method used by anglers in each section of the Middle Missouri River during the 2019 creel survey.

	Percent of Anglers					
Method	Overall	Upper	Middle	Lower	Robinson	Marias
Bank	64.8	72.8	37.6	75.7	52.2	95.7
Bank/Canoe	1.2	0.0	11.1	0.0	0.0	0.0
Bank/Boat	15.2	4.8	23.1	12.3	26.2	2.2
Boat	15.3	19.9	6.8	10.2	21.6	2.2
Canoe	3.4	2.6	21.4	1.7	0.0	0.0
# of Interviews	1064	272	117	235	347	93

Table 5. Angler target species in each section of the Middle Missouri River during the 2019 creel survey.

	Percent of Anglers					
Target Species	Overall	Upper	Middle	Lower	Robinson	Marias
No Target Species	21.4	35.3	23.5	5.1	20.5	22.6
Channel Catfish	20.8	12.1	36.5	11.9	28.8	19.4
Northern Pike	1.2	4.8	0.0	0.0	0.0	0.0
Paddlefish	18.5	0.0	0.0	51.5	21.9	0.0
Sauger	0.0	0.0	0.0	0.0	0.0	0.0
Shovelnose Sturgeon	3.2	1.5	0.0	0.0	2.6	22.6
Smallmouth Bass	0.8	2.9	0.0	0.0	0.0	0.0
Walleye	5.4	7.7	2.6	4.3	5.5	4.3
Specified Multiple Species	27.8	33.8	36.5	27.2	19.9	30.1
# of Interviews	1062	272	115	235	347	93
Percent		25.6	10.8	22.1	32.7	8.8

Table 6. Target species for anglers in each section of the Middle Missouri River that indicated multiple target species during the 2019 creel survey.

	Percent of Anglers					
Target Species	Overall	Upper	Middle	Lower	Robinson	Marias
Channel Catfish/Other spp.	72.2	14.6	12.5	16.3	20.0	8.8
Northern Pike/Other spp.	20.3	12.9	5.4	0.3	1.7	0.0
Paddlefish/Other spp.	24.4	0.0	0.0	13.2	11.2	0.0
Sauger/Other spp.	20.7	7.8	0.3	5.8	6.4	0.3
Shovelnose Sturgeon/Other spp.	21.4	5.4	0.0	2.0	5.1	8.8
Smallmouth Bass/Other Spp.	12.9	10.2	1.0	0.3	0.7	0.7
Walleye/Other spp.	56.3	23.4	8.8	11.2	11.9	1.0

[1] The columns do not add up to 100% as there is overlap between the bait types in the first column.

Table 7. The types of bait used by anglers in each section of the Middle Missouri River during the 2019 creel survey.

	Percent of anglers					
Bait Type	Total	Upper	Middle	Lower	Robinson	Marias
Artificial Lure Only	7.3	14.3	22.2	3.0	0.6	4.3
Artificial Lure Combo	15.9	33.5	37.6	6.0	2.3	12.9
Treble Hook Only	14.0	0.0	0.0	41.3	15.0	0.0
Treble Hook Combo	25.3	0.0	0.0	68.1	31.4	0.0
Live Bait Only	2.1	1.8	0.9	1.3	3.7	0.0
Live Bait Combo	13.5	14.7	13.7	10.2	18.2	1.1
Prepared Bait Only	3.4	1.5	0.9	1.3	6.1	7.5
Prepared Bait Combo	27.0	16.5	36.8	20.9	31.4	44.1
Worms Only	30.1	43.8	27.4	14.0	28.0	44.1
Worms Combo	68.6	80.5	70.9	43.4	70.0	87.1
# of Interviews	1064	272	117	235	347	93

[1] The columns do not add up to 100% as there is overlap between the bait types in the first column.

Table 8. Angler catch rates (fish/hr) and release statistics of common species[1] by section during the 2019 Middle Missouri River Creel Survey. Interviews for anglers that were solely snagging for Paddlefish were excluded.

			Catch Rate (fish/hr)					
Species	Fate	Number	Overall	Upper	Middle	Lower	Robinson	Marias
Burbot	Caught	7	<0.01	<0.01	0.00	<0.01	0.00	<0.01
	Released	3	<0.01	<0.01	0.00	<0.01	0.00	0.00
Common Carp	Caught	162	0.03	0.08	0.01	0.02	0.02	0.03
	Released	132	0.03	0.06	<0.01	0.01	0.02	0.01
Channel Catfish	Caught	658	0.14	0.06	0.12	0.17	0.21	0.10
	Released	334	0.07	0.02	0.06	0.07	0.13	0.02
Freshwater Drum	Caught	412	0.09	0.14	0.07	0.05	0.08	0.03
	Released	305	0.07	0.10	0.05	0.03	0.07	0.01
Goldeye	Caught	906	0.19	0.34	0.22	0.15	0.08	0.20
	Released	788	0.17	0.32	0.18	0.10	0.08	0.14
Northern Pike	Caught	30	0.01	0.02	<0.01	<0.01	<0.01	0.00
	Released	9	<0.01	0.01	<0.01	<0.01	0.00	0.00
Pallid Sturgeon	Released	78	0.02	<0.01	0.00	0.02	0.04	0.00
Sauger	Caught	39	0.01	0.01	<0.01	0.01	0.01	0.01
	Released	17	<0.01	0.01	<0.01	0.01	<0.01	<0.01
Shovelnose Sturgeon	Caught	66	0.01	0.01	0.01	0.01	0.02	0.02
	Released	46	0.01	<0.01	0.01	0.01	0.02	0.01
Smallmouth Bass	Caught	49	0.01	0.03	<0.01	<0.01	<0.01	0.00
	Released	36	0.01	0.02	<0.01	<0.01	<0.01	0.00
Walleye	Caught	78	0.02	0.02	0.01	0.03	0.01	0.00
	Released	28	0.01	0.01	0.00	0.01	<0.01	0.00
# of Hours Fished			4659.3	1333.4	597.6	601.4	1714.9	412.0
# of Interviews			915	272	117	138	295	93

[1] Additional species captured included; Bigmouth Buffalo, Flathead Chub, Rainbow Trout, Smallmouth Buffalo, Stonecat, Shorthead Redhorse, White Sucker, and Spiny Softshell Turtle.

Table 9. Comparisons of Sauger, Shovelnose Sturgeon, Channel Catfish, Smallmouth Bass, and Walleye catch rates (fish/hr) by section between the 1977-78[1] (Berg 1981), the 2003 (Gardner and Leathe 2005), 2007[2] (Gardner and Wente 2008), 2011(Tews and Gardner 2011), 2015 (Tews 2016), and 2019 Middle Missouri River Creel Surveys.

Species		Total Catch (#)	Overall	Upper Section	Marias, Middle & Lower Sections	Robinson Section
Sauger	1977-78			0.40	0.14	0.07
	2003	47	0.04	0.02	0.60	0.04
	2007	230	0.09	0.16	0.08	0.03
	2011	355	0.14	0.16	0.15	0.07
	2015	686	0.22	0.03	0.33	0.25
	2019	39	0.01	0.01	0.01	0.01
Shovelnose Sturgeon	1977-78			0.02	0.19	0.02
	2003	33	0.03	0.01	0.05	0.01
	2007	78	0.03	0.08	0.02	0.01
	2011	72	0.03	0.03	0.03	0.03
	2015	81	0.03	0.01	0.03	0.03
	2019	66	0.01	0.01	0.01	0.02
Channel Catfish	1977-78			0.20	0.16	0.09
	2003	82	0.08	0.04	0.11	0.04
	2007	213	0.09	0.04	0.10	0.09
	2011	380	0.15	0.15	0.11	0.28
	2015	377	0.12	0.09	0.14	0.13
	2019	657	0.14	0.06	0.14	0.21
Smallmouth Bass	1977-78	0	0.0	0.0	0.0	0.0
	2003	18	0.02	0.07	0.01	0.0
	2007	190	0.08	0.29	0.01	0.0
	2011	68	0.03	0.09	0.01	0.0
	2015	253	0.08	0.28	0.01	0.0
	2019	49	0.01	0.03	<0.01	<0.01
Walleye	1977-78			<0.01	0.0	0.0
	2003	30	0.03	0.03	0.03	0.02
	2007	93	0.04	0.07	0.03	0.02
	2011	135	0.05	0.13	0.03	0.06
	2015	248	0.08	0.08	0.08	0.08
	2019	78	0.02	0.02	0.02	0.01
Overall	2003	610	0.48			
	2007	1619	0.65			
	2011	2189	0.86			
	2015	3038	0.91			
	2019	2711	0.50			

[1] Berg's Middle and Robinson sections differ from later years;

[2] 2007 Creel did not include Robinson Section until late June.

Table 10. Total number of fish measured, mean length (mm), length range (mm), mean age (yrs), and number of fish aged during the 2019 Middle Missouri River Creel Survey. Total length for all species except fork length for Shovelnose Sturgeon.

Species	Number	Average Total Length (mm)	Length Range (mm)	N for Age	Mean Age
Channel Catfish	41	530	343-841	37	9.3
Sauger	7	364	295-340	7	3.5
Shovelnose Sturgeon	11	826	625-958	4	22.3
Smallmouth Bass	4	398	343-485	4	5.9
Walleye	8	447	340-711	8	4.0

Table 11. Total number of fish measured, mean length (mm), and length range (mm) of fish captured during the 2019 standard trammel netting and electrofishing efforts in the Middle Missouri River. Total length for all species except fork length for Shovelnose Sturgeon.

Species	Number	Average Total Length (mm)	Length Range (mm)
Channel Catfish	310	579	160-862
Sauger	225	363	187-530
Shovelnose Sturgeon	372	754	373-1028
Smallmouth Bass	98	298	150-436
Walleye	372	376	218-751

Table 12. Total number of fish measured (N), mean length (mm), and mean age (yrs) for common game species during the last three Middle Missouri River Creel Surveys. Total length for all species except fork length for Shovelnose Sturgeon.

Year	2011			2015			2019		
Species	N	Length (mm)	Age	N	Length (mm)	Age	N	Length (mm)	Age
Channel Catfish	51	432	6.2	44	483	--	41	530	9.3
Sauger	14	383	4.3	20	444	7	7	364	3.5
Shovelnose Sturgeon	5	845	--	4	799	--	11	826	22.3
Smallmouth Bass	16	340	3.8	23	332	5.1	4	398	5.9
Walleye	17	411	5	29	404	6.7	8	447	4.0

Table 13. Angler satisfaction with number and size of fish captured during the 2019 Middle Missouri River Creel Survey using primary interviews. N=741.

Ranking	# Satisfaction %	Size Satisfaction %
1 (lowest)	7.6	6.5
2	4.7	4.6
3	6.9	8.2
4	8.1	8.2
5 (highest)	18.5	18.2
No Response	54.3	54.3
Average Ranking	**3.6**	**3.6**

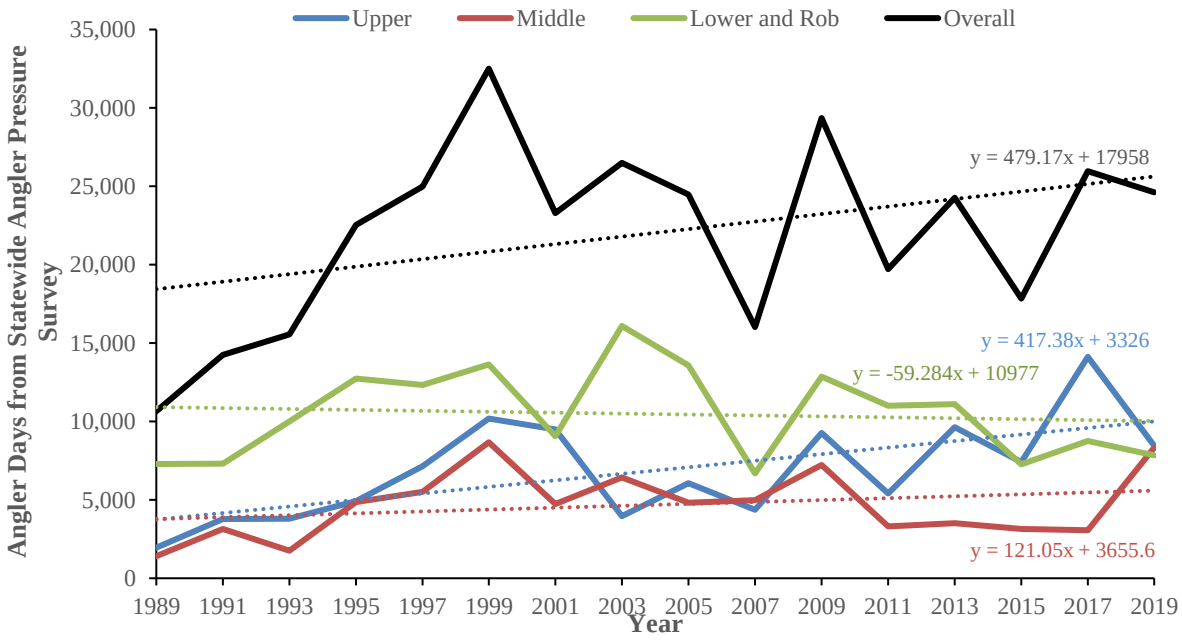

Figure 5. Angler days from the FWP Statewide Angling Pressure Mail Survey by section from 1989 to 2019 with linear trendlines (dotted lines) and their equations.

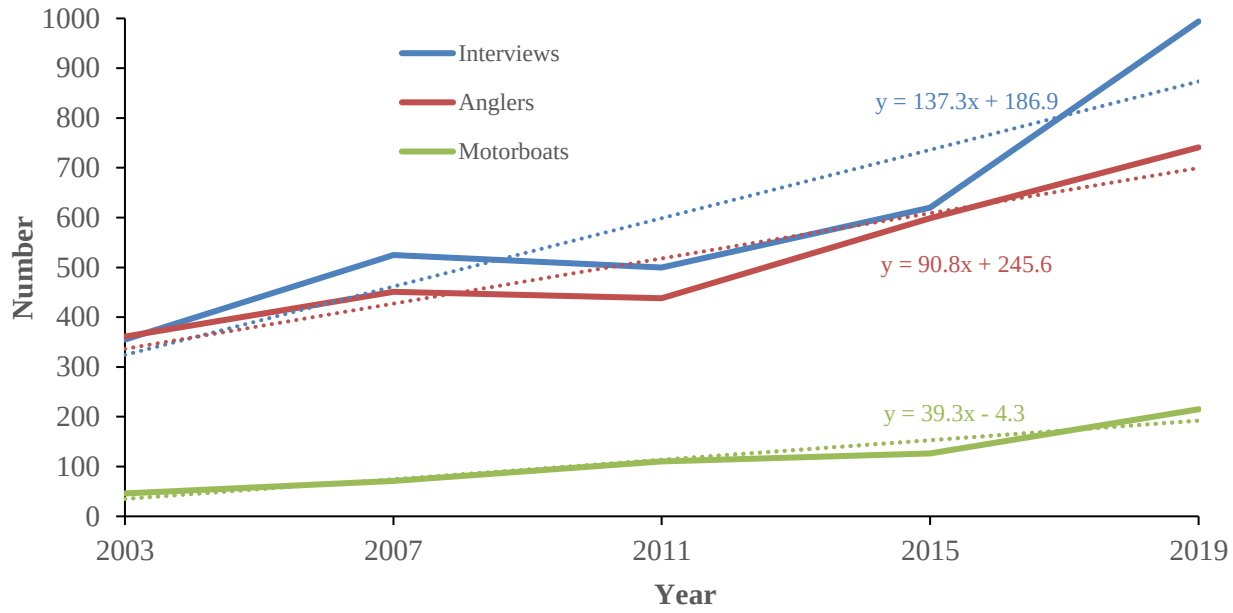

Figure 6. Total number of interviews conducted, anglers interviewed, and motorboats observed during all Middle Missouri River Creel Survey years with linear trendlines (dotted lines) and their equations.

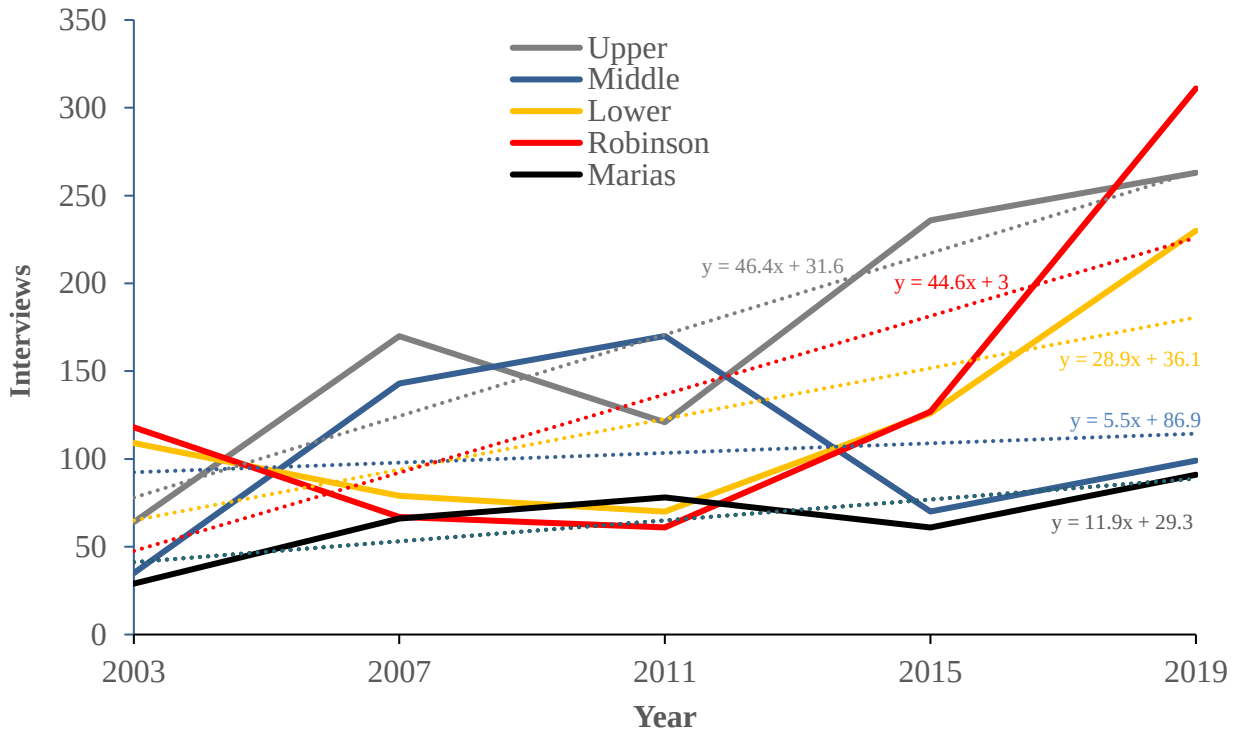

Figure 7. Total number of interviews conducted by section through all Middle Missouri River Creel Survey years with linear trendlines (dotted lines) and their equations.

Table 14. Total fishing pressure (angler-days) for the Middle Missouri River from Morony Dam to the headwaters of Fort Peck Reservoir for 1989 through 2019 from May to September only. Data from FWP Statewide Fishing Pressure Mail Survey (1989-2019). Creel survey years are in bold.

Year	Upper Section (Sec 7)	Middle Section (Sec 6B)	Lower & Robinson Sections (Sec 6A/6)	Overall	Overall Angler Trips	% Non-resident days	% Non-resident trips
1989	1,953	1,410	7,290	10,653			
1991	3,788	3,151	7,304	14,243			
1993	3,807	1,756	9,999	15,562			
1995	4,927	4,870	12,740	22,537			
1997	7,146	5,520	12,325	24,991			
1999	10,185	8,674	13,643	32,502			
2001	9,487	4,736	9,064	23,287			
2003	**3,960**	**6,434**	**16,093**	**26,487**	**673**	**14**	**16.2**
2005	6,068	4,818	13,579	24,465	564	20.7	19.7
2007	**4,362**	**4,973**	**6,689**	**16,024**	**298**	**17.5**	**16.1**
2009	9,260	7,229	12,859	29,348	661	18.6	17.9
2011	**5,413**	**3,310**	**10,994**	**19,717**	**510**	**20.5**	**21.4**
2013	9,638	3,523	11,105	24,266	343	19.6	21.9
2015	**7,407**	**3,155**	**7,275**	**17,837**	**201**	**6.1**	**8**
2017	14,123	3,073	8,758	25,954	204	6.2	7.4
2019	**8,452**	**8,321**	**7,846**	**24,620**	**270**	**13.4**	**10.4**

Figure 8. Pallid sturgeon identification sign at the Wood Bottom Boat Launch near Loma, Montana.

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Acknowledgments

Thank you to Rob Beattie for filling in as creel clerk and to Jason Rhoten and Jake Williams for manuscript review. Mike Wente's excellent work during the 2003 – 2011 Creel Surveys and Erik Argotti's during the 2015 Creel Survey were also critical for evaluating the 2019 data. Thanks to Grant Grisak (NWEC) for coordinating the survey this year and NWEC for funding. Special thanks to Laura Hajek and Debbie Broderick (MFWP) and the volunteer shuttle drivers they coordinated. Those volunteers were very important to complete the weekly surveys in a timely manner.

Appendix 1. The 2019 Middle Missouri River Creel Survey Form.

FWP.MT.GOV THE **OUTSIDE** IS IN US ALL.

2019 Middle Missouri River Creel

One Angler/One trip

Interview #: _____ Trip #:_____ Interview location (RM):_____Date fished: _____
Reach:_____ Time started fishing: ____:_____ Time of interview: ____:_____
Hours fished: ____:_____ Time not fishing: ____:_____
Done fishing for day: ( ) Yes ( ) No *If no, give them card for completed trip*
Area Fished: _____Entry Point (RM): _____ Return Visit @ Site in 2019: YES ( ) NO ( )
Angler Origin: MT (county)_____ Non-Resident (state):_____ Foreign(country): _____
Type of fishing: Bank ( ) Motor Boat ( ) Canoe ( ) Combo ( )
Number of anglers in party:_____ (Record for one member of party only)
Methods: Angling ( ) Setline ( ) Snagging ( )
Tackle: Live bait ( ) Prepared bait ( ) Worms ( ) Artificial lure ( ) Combo ( )
Target fish species: _____

	Rod – Hours: _____		**Setline – Hours: _____**	
Species	**Number Harvested**	**Number Released**	**Number Harvested**	**Number Released**
Sauger				
Walleye				
Shovelnose Sturgeon				
Pallid Sturgeon	Release		Release	
Channel Catfish				
Northern Pike				
Burbot (ling)				
Smallmouth Bass				

On a scale of 1 to 5 please rate your satisfaction with the following;

- The **number** of fish you caught today (circle one): 1 2 3 4 5

Very Unsatisfied Very Satisfied

- The **size** of fish you caught today (circle one): 1 2 3 4 5

Very Unsatisfied Very Satisfied

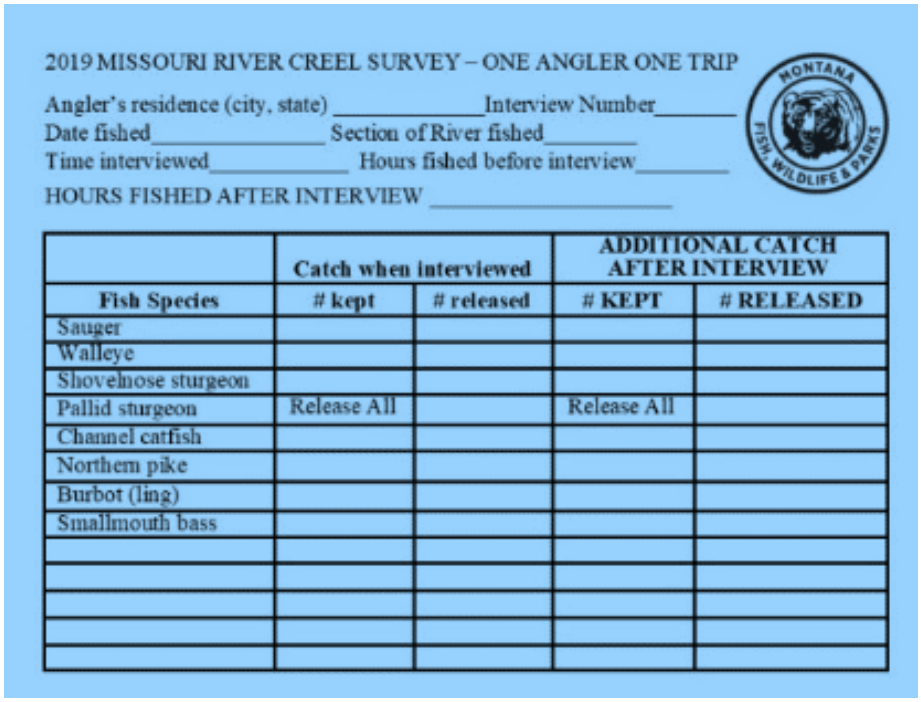
Do you have any comments that you would like to make about the management of this fishery?

Did you fish yesterday? YES ( ) NO ( )

- If yes, fill out second interview sheet with interview # (above) followed by "B"

That completes the interview. Thanks for your time!

Appendix 2. Prepaid postcard given to anglers with uncompleted trips.



2019 MISSOURI RIVER CREEL SURVEY – ONE ANGLER ONE TRIP

Angler's residence (city, state) _____Interview Number_____
Date fished_____ Section of River fished_____
Time interviewed_____ Hours fished before interview_____
HOURS FISHED AFTER INTERVIEW _____

	Catch when interviewed		ADDITIONAL CATCH AFTER INTERVIEW	
Fish Species	**# kept**	**# released**	**# KEPT**	**# RELEASED**
Sauger				
Walleye				
Shovelnose sturgeon				
Pallid sturgeon	Release All		Release All	
Channel catfish				
Northern pike				
Burbot (ling)				
Smallmouth bass				

Appendix 3. Dates and location[1] of 2019 MMR Creel Survey trips and number of different types of recreationists and craft observed by the Creel clerk.

Trip	Date	Location	Miles Covered	Total # People	% Anglers	# Motor Boats	# Non-Motorized
1	4/18-21	Above	154.1	60	51.7	5	10
2	4/25-27	Below	102.3	17	70.6	2	0
3	5/2-5	Above	154.1	14	85.7	4	1
4	5/9-12	Below	102.3	185	74.1	32	3
5	5/16-19	Above	154.1	106	58.5	8	15
6	5/23-26	Below	102.3	215	83.3	35	0
7	5/30-6/2	Above	154.1	58	43.1	4	15
8	6/6-9	Below	102.3	114	76.3	9	3
9	6/13-16	Above	154.1	152	72.4	10	17
10	6/20-21	Below	43.9	15	0.0	0	8
11	6/27-30	Below	78.7	27	66.7	3	7
12	7/4-7	Above	154.1	115	41.7	12	52
13	7/11-14	Below	102.3	25	4.0	1	7
14	7/18-21	Above	154.1	136	39.7	9	47
15	7/25-28	Below	102.3	12	58.3	2	3
16	8/1-4	Above	154.1	74	33.8	11	39
17	8/9-13	Above	154.1	42	19.0	5	21
18	8/15-18	Below	102.3	35	17.1	2	15
19	8/22-25	Above	154.1	26	50.0	8	7
20	8/29-9/1	Below	102.3	62	72.6	9	6
21	9/5-8	Above	154.1	49	24.5	6	22
22	9/12-15	Below	102.3	63	33.3	18	11
23	9/19-22	Below	102.3	54	40.7	19	1
24	9/26-27	Above	103	1	100.0	1	0
		Total	**2943.7**	**1657**	**56.5**	**215**	**310**

[1] Location refers to either above or below Judith Landing.

Appendix 4. Individual angler comments recorded during the 2019 MMR Creel Survey. A total of 134 comments from the day of interview were included. Comments that were similar to one another were summarized into a single comment that captured the message of all those comments (number of comments included in parenthesis).

Species:

- Bigger sturgeon in the Missouri River.
- Make the Missouri River a better smallmouth bass fishery.
- Stock more fish in the Missouri River (3 comments).
- Stop stocking walleye in Fort Peck Reservoir.

Fishing regulations:

- Add a limit on bigmouth and smallmouth buffalo and other native species.
- Change the paddlefish regulations so everyone gets a tag and must keep the first one they catch.
- Clarify the special fishing regulations for the Missouri River.
- Create a come home to fish program for previous residents.
- Either eliminate snag and release for paddlefish or limit the number of snag and release tags.
- Eliminate the use of set lines on the Missouri River (2 comments).
- Fish limits seem good.
- Get rid of snag and release fishing for paddlefish (3 comments).
- Get rid of the cost of an annual fishing license for non-residents to apply for a paddlefish tag.
- Get rid of the current paddlefish tag drawing system (4 comments).
- I like being able to snag and release paddlefish (2 comments).
- I like the current paddlefish tag drawing system (6 comments).
- I would like to be able to harvest a pallid sturgeon eventually.
- Implement a slot limit on walleye to reduce the number of big fish being kept and introduce a new baitfish species.
- Increase the length of the motorboat season near Judith Landing.
- Increase the number of paddlefish tags (3 comments).
- Increase the sauger limit (6 comments).
- Keep the people who draw a paddlefish tag and purposefully don’t fill it out of the system.
- Keep the river above Fred Robinson Bridge open year-round to motorboats (2 comments).
- Lower the walleye limit between Great Falls and Holter Dam (2 comments).
- Mothers should be able to fish free on Mother's Day.
- Reduce the daily limit to 3 walleye and 1 sauger.
- Reduce the number of setlines allowed to 3 or less.
- Refund the angler if they do not draw a paddlefish tag.
- We love the free Father's Day fishing.

Land management :

- Add more camping sites at James Kipp Recreation Area (2 comments).
- Better gravel and upkeep on fishing access sites.

- Build a boat access site on Marony Reservoir even if it is a no wake only reservoir.
- Clear the downed trees in Doney Bottom to improve river access.
- Expand the current campground at James Kipp Recreation Area and increase access into the breaks (2 comments).
- Fix the Carter Ferry boat ramp (4 comments).
- Fix the road into Rock Creek (6 comments).
- Fix the Rock Creek boat ramp (3 comments).
- Get rid of the moss floating down the river (3 comments).
- Increase access to the Missouri River (5 comments).
- Keep the Missouri Breaks the way they are and do not add more access.
- Make it easier to launch a boat at Carter Ferry by making it deeper.
- Pick up the trash or add a trash can at the Fort Benton boat ramp.
- Pick up the trash or add a trash can upstream from Widow Coulee FAS.
- Require outfitters and guides to pay a fee in free camping areas when they set up large camps in advance for clients.
- There is great public access to the river.
- Work on the road into Rock Creek and put a sign up at Doney Bottom and Slippery Anne when they are full.

Other:

- Add more restrooms on the river.
- Clean the bathrooms at Loma Bridge.
- Fishing the Missouri is fun!
- I am thankful to the landowner (Mr. Jensen) for allowing access to the Marias River near Loma, MT.
- Montana Fish, Wildlife, and Parks is doing a good job (28 comments).
- More wardens out checking fishing licenses.
- Open the paddlefish cleaning station again.
- Patrol Widow Coulee FAS more and clean up the trash.
- Satisfied with the fishing (6 comments).
- Stop canoers from floating through fishing lines and tearing them up.
- This is a great fishery (3 comments).
- We like coming here.